

The highest was 78° at Hamilton on the 11th, and the lowest, 34° below zero, at Stofiel on the 18th. The average precipitation was 0.42, or 1.26 below normal. It was extremely light all over the State. The deficiency amounted to 4.12 at Tuscarora, and the only excess was at Wadsworth. The greatest monthly was 3.07, at Lewers Ranch, and the least, 0.00, at Las Vegas and St. Thomas.

New England.—The mean temperature was 31.5°, or 3.2° above normal. The highest, 71°, at Norwalk on the 26th, and the lowest, 20° below zero, at Berlin Mills and Enosburg on the 13th. The average precipitation was 3.12, or 0.44 below the normal. The greatest monthly amount was 6.88 at North Conway, and the least, 1.40, at New London. The ground was not well covered with snow during the month and it is feared the frequent thawing and freezing of the surface of the ground has injured grass and grain roots. The want of snow has been severely felt in the lumber districts.

New Jersey.—The mean temperature was 37.2°, or 4.7° above normal. The highest was 76°, at Moorestown on the 20th, and the lowest, 3°, at Deckertown and Newton on the 13th. The average precipitation was 2.61, or 1.01 below normal. The greatest monthly was 5.42, at Englewood, and the least, 1.71, at Barnegat.

New Mexico.—The average temperature during the month was decidedly below normal, and, with one exception, was the coldest December since the establishment of the station at Santa Fe, in 1871. The highest temperature was 73°, at Eddy on the 14th and Roswell on the 16th, and the lowest, 23° below zero, at Ranches of Taos, on the 30th. The average precipitation was considerably above normal and was fairly well distributed over the Territory. The greatest total was 2.90, at Chama. Aztec, Engle, and Olio reported only a "trace" and San Marcial, 0.00.

New York.—The mean temperature was 3.1° above normal. The highest temperature was 69°, at Victor on the 20th, and the lowest, 18° below zero, at Saranac Lake on the 15th. The average precipitation was 3.70, and was generally above the normal. The greatest monthly was 6.31, at Canton, and the least, 1.68, at Middletown.

North Carolina.—The mean temperature was 42.4°, or 0.3° below normal. The highest was 76°, at Newbern, on the 2d, and the lowest, 5°, at Linville and Waynesville on the 6th. The average precipitation was 3.4, or 0.59 below normal. The greatest amount was 8.49, at Linville, and the least, 1.03, at Rutherfordton.

North Dakota.—The mean temperature was 13.8°, or 0.2° above normal. The highest was 62°, at Berthold Agency, on the 27th, and the lowest, 32° below zero, at Steele on the 1st. The average precipitation was 0.29, or 0.61 below normal. The greatest amount was 0.88, at White Earth, and the least, 0.03, at Willow City.

Ohio.—The mean temperature was 33.9°, or 1.2° above the normal. The highest was 79°, at Coalton on the 20th, and the lowest, 13° below zero, at Warsaw on the 13th. The average precipitation was 3.85, or 1.25 above the normal. The greatest was 6.72, at Wauseon, and the least, 1.65, at Thurman. Precipitation occurred at various points in the State on every day of the month, and, in the main, was very well distributed.

Oklahoma.—The mean temperature was 39.4°, or 0.9° below normal. The highest was 86°, at Hennessey on the 6th, and the lowest, 8° below zero, at Hennessey on the 20th. The average precipitation was 4.14, or 1.69 above normal. The greatest monthly total was 12.70, at Vinita, and the least, 0.65, at Alva.

Oregon.—The mean temperature was 38.8°, or 0.1° above normal. The highest was 68°, at Langlois on the 11th, and the lowest, 17° below zero, at Lorella on the 29th. The average precipitation was 10.62, or 4.34 above normal. The greatest monthly was 25.10, at Nehalem, and the least, 0.59, at Dayville. The precipitation exceeded all previous records for this month, the amount being almost 1.00 more than the next rainiest December, which was that of 1891, with an average of 9.72. The number of rainy days was unusually large. The station at Government Camp, on Mount Hood, reported a total fall of snow during the month of 130 inches.

The observer at Tillamook, Tillamook County, reports as follows:

Friday, December 13, there was an unusual electric display in this vicinity. There were several vivid displays of sheet lightning across the heavens, seeming to permeate all space with flashes of fire, accompanied with tremendous crashes of thunder. Several trees and houses were struck, though no serious damage was done. The public school building was struck, and the balls of fire rolled around promiscuously in every room. The same phenomena was noticed in several dwelling-houses, and several cases of electrical burnings are reported. Lightning came into the telegraph office, but did little damage there. Nothing like it was ever seen before, so all say, and it seems the whole

locality was pervaded with the peculiar electrical demonstration. The storm was followed by a very low barometer.

Pennsylvania.—The mean temperature was 34.2°, or 1.5° above normal. The highest was 70°, at Shinglehouse on the 21st, and the lowest, 10° below zero, at Hollidaysburg on the 14th. The average precipitation was 3.22, or 0.05 below the normal. The greatest monthly amount was 6.55 at Wellsboro, and the least, 1.40, at Doylestown.

South Carolina.—The mean temperature was 46.1°, or 2.2° below normal. The highest was 80°, at Slaws Forks on the 25th, and the lowest, 13°, at Gillisonville on the 6th and at Central on the 13th. The average precipitation was 3.04, or 0.19 below normal. The greatest monthly amount was, 6.55, at Holland, and the least, 1.25, at Central.

South Dakota.—The mean temperature was 22.7°, or about 2.0° above normal. The highest was 69°, at Fort Meade on the 12th, and the lowest, 25° below zero, at Webster on the 2d. The average precipitation was 0.17, or about 0.46 below the average. The greatest monthly amount reported was 1.43, at Webster, and the least, a "trace," at several stations. The month, as a whole, was an unusually pleasant one.

Tennessee.—The mean temperature, 41.3, was normal. The highest was 78°, at Waynsboro on the 15th and 23d, and the lowest, 2°, at Rugby on the 6th. The average precipitation was 4.20, or about 0.25 above normal. The greatest monthly was 7.35, at Tullahoma, and the least, 1.59, at Bristol.

Texas.—The average temperature for the State was 3.1° below normal. It was generally deficient, except in the northeastern portion of southwestern Texas, where the excess amounted to 1.0°. The precipitation averaged, for the State, 0.43 below normal. There was an excess of from 0.11 to 2.07 along the east coast, which extended less than 25 miles inland, and an excess north of the thirty-first parallel of latitude, east of the one hundredth meridian, of from 0.06 to 2.01. Over other portions of the State there was a general deficiency, greatest over southwestern Texas and the southern portions of central Texas, where less than 40 per cent of the normal amount occurred. The greatest local monthly amount was 6.10, at Marshall, and the least 0.00, at Fort Ringgold.

Utah.—The mean temperature was 21.0°, or about 7.0° below normal. The highest was 64°, at St. Georges on the 12th, and the lowest, 24° below zero, at Fort Du Chesne, on the 18th. The average precipitation was 0.78. The greatest monthly rainfall was 1.70, at Heber and the least, "trace," at Cisco, Giles, and Grover. The snowfall averaged 9 inches.

Virginia.—The mean temperature, 39.0°, does not show any marked departure from the normal. The highest, 76°, occurred at Ashland on the 24th and 25th, and the lowest, 1° below zero, at Dale Enterprise on the 14th. The average precipitation was 2.89. There was no great departure from the normal, except at Alexandria. It was generally uniformly distributed over all sections. The greatest monthly amount was 6.29, at Cape Henry, and the least, 0.58, at Alexandria. Snow fell in all sections, but most frequently and heaviest in the western counties.

Washington.—The mean temperature was 37.4°, or 0.6° below normal. The highest was 66°, at Connell on the 14th, and the lowest, 8° below zero, at Ellensburg and Moxee on the 22d. The average precipitation was 9.00, or 2.86 above normal. The greatest rainfall for the month, 28.14, occurred at Monte Cristo, and the least, 0.42, at Moxee. This was one of the stormiest months on record. Rainstorms occurred almost daily, and severe windstorms followed each other in rapid and constant succession, but none were so severe as those of December 5-12, 1894. At many stations there were only two or three days on which there was no rain. Snow to the depth of 198 inches fell at Monte Cristo and 165 inches at Cascade. The extraordinary depth of snow caused extensive blockades in the mountains.

West Virginia.—The mean temperature was 36.8°, or very nearly normal. The highest was 72°, at Bluefield and Hewett on the 25th, and the lowest, 6° below zero, at Bloomery on the 14th. The average precipitation was 2.91, or about normal, and was quite evenly distributed. The greatest monthly total, 4.14, occurred at Marlinton, and the least, 1.85, at Morgantown. Greatest depth of snowfall 9.6 at Marlinton.

Wisconsin.—The mean temperature was 25.1°, or 3.1° above normal. The highest was 60°, at Antigo on the 21st, and the lowest, 26° below zero, at Butternut on the 30th. The average precipitation was 0.54, or 0.38 below normal. The greatest monthly was 3.44, at Sharon, and the least, 0.16, at Osceola Mills. The average snowfall was 4.4 inches. The greatest amount was 15.5 inches, at Butternut.

Wyoming.—The mean temperature was 23.0°, or slightly below normal. The highest was 70°, at Embur on the 12th, and the lowest, 16° below zero, at Sheridan on the 2d, and Laramie on the 29th. The average total precipitation was 0.45, or about normal. The greatest monthly was 2.10 at Sundance, and the least, 0.00, at Lander and Fort Washakie.

SPECIAL CONTRIBUTIONS.

THOMAS JEFFERSON AS METEOROLOGIST.

By FRED. J. RANDOLPH and FRED. L. FRANCIS, of the Weather Bureau.

The following items are extracted from notes furnished to the Editor by the gentlemen above-named. Further interest-

ing remarks on this subject will be found in articles by Mr. Alexander McAdie, published in the Popular Science Monthly, Vol. XLV, p. 331, and in Weather Bureau Bulletin No. 11.

Monticello (in Italian "Little Mountain"), the home of



FIG. 1.—Monticello, the home of Thomas Jefferson.

Thomas Jefferson, is on the summit of Monticello Mountain, on the south side of the Ravenna River in Albemarle County, and three miles southeast of Charlottesville, Va. This mountain, which towers up more than five hundred feet above the general level, commands a magnificent view of all the country to the north and east. The birthplace of Thomas Jefferson, called Shadwell, named after the parish in London, where his mother was born, is a couple of miles away.

The accompanying illustration (Fig. 1) shows the front of the Monticello mansion facing east. The general appearance of the building has undergone no alteration or change since Mr. Jefferson's death. The central portion consists of two stories with a dome surmounting the center; the wings are of one story and attic.

Mr. Jefferson was one of the pioneer meteorologists of this country. He kept daily records of the temperature and other important weather conditions during the greater part of his life; he induced others in different parts of the country to make records simultaneously with his own observations; he collected and charted the results, and drew from them his own conclusions with regard to the character and movement of storms, etc. These conclusions were remarkably accurate considering the meager data at his command for such investigations. The photograph of Monticello shows on the roof a part of his instrumental equipment, viz, the wind-vane, the construction of which is very similar to the modern vane. The vertical rod supporting the vane projects down to the ceiling of the portico, to the lower end of which is attached an arrow that indicates by its position on a lettered dial the direction of the wind at any moment, and this can be seen from within the house. Mr. Jefferson made and recorded his weather observations several times each day, and these were not neglected even during the performance of his most important and engrossing public duties. In Paris, during a time when his right arm was disabled, in consequence of a fall, his weather records were made with his left hand. Even during the exciting debate in Congress on the document which he had written, one of the noblest in the annals of the world—the Declaration of Independence—when he was writhing under the bitter criticisms with which it was attacked in some of its parts, his observations of temperature were continued. The record in his pocket memorandum book contains the following entries:

Philadelphia, 1776.

	H.	Min.	°
July 1	9	0 a. m.	81½
.....	7	0 p. m.	82
2	6	0 a. m.	78
.....	9	40 a. m.	78
.....	9	0 p. m.	74
3	5	30 a. m.	71½
.....	1	30 p. m.	76
.....	8	10 p. m.	74
4	6	0 a. m.	68
.....	9	0 a. m.	72½
.....	1	0 p. m.	76
.....	9	0 p. m.	73½

For his temperature readings Mr. Jefferson used a pocket thermometer.

In addition to the above the Editor would call attention to the fact that it is not merely as an observer, but also as a careful investigator and as one who fully appreciated many questions in meteorology that Jefferson is especially entitled to be mentioned in this MONTHLY WEATHER REVIEW. His Notes on Virginia, written in 1781-'82 in response to queries by Volney (printed first in Paris in English, 1784, and afterwards in French, 1786; first edition in America published in 1787, second edition, Philadelphia, 1794, third edition, 1825), gives many evidences of his ability as a climatologist and natural philosopher. His investigations into the theory of the mo-

tions of the atmosphere are explained in a letter written by him in Paris, November 13, 1786. (See The Writings of Thomas Jefferson, published by the order of the Joint Committee of Congress, with explanatory notes by the editor, H. A. Washington, pages 54-60, Vol. II, 1853.) In his Notes on Virginia (page 109 of the edition of Philadelphia, 1825, or page 324 of the reprint in Vol. VIII of The Writings of Thomas Jefferson) he describes certain descending masses of air such as have been the subject of extensive investigation in connection with fœhn phenomena. Speaking of his own experience in the neighborhood of Monticello he says:

Going out into the open air, in the temperate and warm months of the year, we often meet with bodies of warm air, which passing by us in two or three seconds, do not afford time to the most sensible thermometer to seize their temperature. Judging from my feelings only, I think they approach the ordinary heat of the human body. Some of them perhaps go a little beyond it. They are of about 20 or 30 feet diameter horizontally. Of their height we have no experience, but probably they are globular volumes wafted or rolled along with the wind. But whence taken, where found, or how generated? They are not to be ascribed to volcanoes because we have none. They do not happen in the winter when the farmers kindle large fires which traverse whole counties, consuming the leaves which have fallen from the trees. And they are too frequent and general to be ascribed to accidental fires. I am persuaded their cause must be sought for in the atmosphere itself, to aid us in which I know but of these constant circumstances, a dry air, a temperature as warm at least as that of the spring or autumn, and a moderate current of wind. They are most frequent about sunset, rare in the middle parts of the day, and I do not recollect having ever met with them in the morning.

In the following paragraph Jefferson alludes to the contemporary observations made at Monticello and Williamsburg, Va., some account of which has been given by Mr. McAdie:

It seems that Jefferson's cousin, Prof. James Madison, of William and Mary College, Williamsburg, Va. (afterwards Bishop Madison), had begun a systematic record of the barometer, thermometer, wind, and rain, and Jefferson, in 1772, began a similar record at Monticello. The comparison of these records seems to have suggested the system of observation explained in the following extract from the letter dated January, 1797, addressed to Mr. Volney, and published at page 341 of Vol. III of T. J. Randolph's Memoir, Correspondence, etc:

I am sorry that you have received so little information on the subject of our winds. I had once (before our Revolutionary war) a project on the same subject. As I had then an extensive acquaintance over this State I meant to have engaged some person in every county of it, giving them each a thermometer, to observe that and the winds twice a day for one year, to wit, at sunrise and at 4 p. m. (the coldest and the warmest point of the twenty-four hours) and to communicate their observations to me at the end of the year. I should then have selected the days in which it appeared that the winds blew to a center within the State, and have made a map of them, and seen how far they had analogy with the temperature of the air. I meant this to be merely a specimen to be communicated to the Philosophical Society at Philadelphia, in order to engage them, by means of their correspondents to have the same thing done in every State, and through a series of years. By seizing the days when the winds centered in any part of the United States we might, in time, have come at some of the causes which determine the direction of the winds, which I suspect to be very various. But this long-winded project was prevented by the war which came upon us, and since that I have been far otherwise engaged.

During the past few years there have been several references in the WEATHER REVIEW to the subject of "frostless zones." It is a matter of course that observant farmers in dry climates, such as that of the United States, must always have been familiar with the phenomenon that the meteorologist calls the "inversion of temperature," occurring on still clear nights, but it is interesting to find that Jefferson is the first American author who refers to the subject as in the following extract taken from his Notes on the State of Virginia (see the Philadelphia edition of 1825, page 112):

The access of frost in autumn and its recess in the spring do not seem to depend merely on the degree of cold, much less on the air being at the freezing point. White frosts are frequent when the thermometer is at 47°, have killed young plants of Indian corn at 48°, and have been known at 54°. Black frost, and even ice, have been produced at 38½°.

which is $6\frac{1}{2}^{\circ}$ above the freezing point. That other circumstances must be combined with the cold to produce frost, is evident from this also; on the higher parts of mountains, where it is absolutely colder than in the plains on which they stand, frosts do not appear so early by a considerable space of time in autumn and go off sooner in the spring than in the plains. I have known frosts so severe as to kill the hickory trees round about Monticello, and yet not injure the tender fruit blossoms then in bloom on the top and higher parts of the mountain, and in the course of forty years, during which it has been settled, there have been but two instances of a general loss of fruit on it, while in the circumjacent country the fruit has escaped but twice in the last seven years. The plants of tobacco, which grow from the roots of those which have been cut off in the summer, are frequently green here at Christmas. This privilege against the frost is undoubtedly combined with the want of dew on the mountains. That the dew is very rare on their higher parts, I may say with certainty from twelve years observations having scarcely ever, during that time, seen an unequivocal proof of its existence on them at all during summer. Severe frosts in the depth of winter prove that the region of dews extends higher in that season than the tops of the mountains, but certainly, in the summer season, the vapors by the time they attain that height are become so attenuated as not to subside, and form a dew when the sun retires.

One more extract from the Notes on the State of Virginia showing Jefferson's close observation of the optical phenom-

non known as "looming," which is frequent at sea but rare on land; but as Jefferson says:

At Monticello it is familiar. There is a solitary mountain about 40 miles off in the south, whose natural shape, as presented to view there, is a regular cone, but by the effect of looming it sometimes subsides almost totally in the horizon, sometimes it rises more acute and more elevated, sometimes it is hemispherical, and sometimes its sides are perpendicular, its top flat and as broad as its base. In short, it assumes at times the most whimsical shapes, and all these perhaps successively in the same morning. The Blue Ridge of mountains comes into view in the northeast at about 100 miles distance, and approaching in a direct line passes by within 20 miles and goes off to the southwest. This phenomenon begins to show itself on these mountains at about 50 miles distance and continues beyond that as far as they are seen. I remark no particular state, either in the weight, moisture, or heat of the atmosphere, necessary to produce this. The only constant circumstances are its appearance in the morning only, and on objects at least 40 or 50 miles distant. In this latter circumstance, if not in both, it differs from the looming on the water. Refraction will not account for the metamorphosis. That only changes the proportions of the length and breadth, base and altitude, preserving the general outlines. Thus, it may make a circle appear elliptical, raise or depress a cone, but by none of its laws, as yet developed, will it make a circle appear a square, or a cone a sphere.

NOTES BY THE EDITOR.

METEOROLOGY IN THE PUBLIC SCHOOLS.

Among the improvements in methods of education none is more rational and practically successful than that which insists on requiring the pupils, from the youngest to the oldest, to observe natural phenomena and make their own personal records and deductions. For a century past the favorite field of "nature-study" has been that of botany, and a visitor to the best primary schools will find the children bringing in quantities of leaves, buds, and flowers, which they compare and study, and thus quicken their habits of observation and generalization. Almost equally attractive is the elementary study of the soils, rocks, and minerals. In regions where birds and insects are accessible these also afford fine objects for study. The whole tendency of modern pedagogy is to stimulate the study of nature in every field, especially those most easily accessible. In October, 1882, the present Editor had occasion to give a series of talks to the students of the Normal School in Washington, and to maintain that as we have the weather about us every day it constitutes an admirable subject for youthful observation and study. In accordance with the principles that were then taught at that Normal School it was necessary for each member of the class to record and analyze her own observations on the subject under consideration, in order, by this personal training, to obtain the experience that is necessary to successfully conduct the classes of children that must eventually come under her care. Accordingly, the present writer prepared an elementary printed form for the use of the class in which each member kept a personal diary of the weather, in so far as that could be done without instruments. Specimens of these diaries and an explanation of the whole system were exhibited at the New Orleans Exposition in December, 1884, in the division of pedagogy.

Subsequently the accomplished principal and founder of the Normal School at Washington (Miss Lucilla E. Smith) was called to take charge of a part of the work of the Training School for Teachers in Brooklyn, N. Y. In such a location where botany and geology are not so easily studied she again had occasion to advocate the observation and study of atmospheric phenomena as a means of training the perceptive faculties of the pupils. This idea, which was at first so novel, has been practically carried out during the past two years, and many have testified that not only the scholars but the teachers

themselves have profited greatly by this drill. Each child is expected to keep a record of the wind and weather, and the discussions that take place are rapidly disabusing the children's minds of erroneous ideas that are widely disseminated. The trite weather sayings that have been current for centuries, and that have no real basis of fact, yet are handed down like myths and legends *viva voce*, from parent to child, are now daily brought to the test of actual experience, and a healthy stimulus is given to the study of nature. The children, and even the teachers, begin to wonder at the numerous erroneous notions formerly entertained and to admire the clearer vision that they are now rapidly attaining. This feature in the study of nature was advocated before the Brooklyn Institute, in 1893, and the teaching of meteorology in the schools has since then received enthusiastic endorsement. Probably Miss Smith was the first in this country to introduce this study, first into the Normal School and then into the public schools of all the lower grades. The future development of meteorology in this country will largely depend upon the extent to which it is taught in the public schools. The special meteorologists of future generations will, undoubtedly, look back to the time when, as school children, their attention was first seriously directed to this study.

THE GENERAL CIRCULATION OF THE ATMOSPHERE.

On several occasions the Editor has in the MONTHLY WEATHER REVIEW enforced the principle that the important peculiarities of any season depend upon what is called the general circulation of the earth's atmosphere. That is to say, an unusual drought or a remarkable series of rains, or the so-called apparent secular change in the general climate of any locality is not at all to be considered as dependent, even to the slightest extent, upon the destruction of forests, the cultivation of the surface of the ground, the local evaporation, the presence of lakes or rivers, etc. Even great forest fires have been shown to have little influence on the subsequent weather. All these phenomena affect the air that is temporarily at the surface of the earth, but as soon as this air is raised and carried off into the cloud region, it is mixed with such a large mass of other air that its special influence becomes greatly diminished, and is felt, if at all, in some far distant region and at some distant time. It is very easily shown that the strong winds, and with them the temperature